CLAIMS

What is claimed is:

1 1. A method of converting an abstract quality of service policy into a new configuration

2   for one or more network devices, the method comprising the computer-implemented

3   steps of:

4   receiving and converting the abstract quality of service policy into a first set of one or

5   more basic commands;

6   receiving one or more first command line interface (CLI) commands that represent a

7   current configuration of a network device;

8   determining a second set of one or more basic commands that correspond to the

9   current configuration of the network device, based on the first CLI commands;

10   transforming the first and second sets of basic commands into one or more second

11   CLI commands which, when executed by the network device, will create a

12   new configuration for the network device that implements the abstract quality

13   of service policy.

1 2. A method as recited in Claim 1, wherein the step of transforming the first and second

2   sets of basic commands comprises the steps of merging and aggregating the first and

3   second sets of basic commands by eliminating duplicate commands and combining

4   similar commands.

1 3. A method as recited in Claim 2, wherein the steps of receiving and converting the

2   abstract quality of service policy comprise the steps of:

3   receiving and analyzing one or more abstract policies that are defined by a user using

4   a quality of service management system;

5   creating one or more corresponding instances of basic command objects, to result in

6   creating and storing an initial set of basic commands that represent the abstract

7   policies.

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1   4.   A method as recited in Claim 3, wherein the steps of receiving one or more first
2   command line interface (CLI) commands and determining a second set of one or more
3   basic commands comprise the steps of:
4   receiving the initial set of basic commands;
5   analyzing a current configuration of the network device;
6   determining a third set of one or more CLI commands which, if executed by the
7   network device, would result in creating the current configuration;
8   converting the third set of one or more CLI commands into a set of one or more
9   uploaded basic commands.

1   5.   A method as recited in Claim 4, wherein the steps of merging and aggregating the first
2   and second sets of basic commands comprises the steps of:
3   receiving the set of uploaded basic commands;
4   comparing the initial set of basic commands to the set of uploaded basic commands;
5   creating and storing a final list of basic commands by determining a minimal set of
6   basic commands which, if executed by the network device, would result in
7   creating a new device configuration that implements the abstract policy.

1   6.   A method as recited in Claim 5, further comprising the steps of assigning a state value
2   of each basic command in the final list of basic commands upon creation of each
3   basic command.

1   7.   A method as recited in Claim 6, wherein the step of transforming the first and second
2   sets of basic commands comprises the steps of:
3   receiving the final list of basic commands;
4   based on the state value of each basic command in the final list, translating each basic
5   command in the final list into one or more second CLI commands which,
6   when executed by the network device, will create a new configuration for the
7   network device that implements the abstract quality of service policy.

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1 8. A method as recited in Claim 1, further comprising the step of assigning a state value
2   of DO to each basic command in the first set upon creation of such basic command,
3   wherein such state value indicates that the associated basic command must be
4   deployed to the network device as part of deploying the new configuration.

1 9. A method as recited in Claim 1, further comprising the step of selectively assigning a
2   state value UNDO or EXIST to each basic command in the second set of basic
3   commands, wherein a state value of UNDO indicates that the associated basic
4   command should be removed from the network device as part of deploying the new
5   configuration, and wherein a state value of EXIST indicates that the associated basic
6   command is currently configured on the network device and may be removed or
7   retained as part of deploying the new configuration.

1 10. A method as recited in Claim 8, wherein the steps of merging and aggregating the first
2   and second sets of basic commands comprises the steps of:
3   based on the state value of each basic command in the final list, translating each basic
4   command in the final list into one or more second CLI commands which,
5   when executed by the network device, will create a new configuration for the
6   network device that implements the abstract quality of service policy;
7   when two of the basic commands in the final list are equivalent without considering
8   their associated state values, and when one of the two commands has a state
9   value of DO and the second of the two commands has a state value of UNDO,
10   merging the two commands into one new command having a state value of
11   EXIST.

1 11. A computer-readable medium carrying one or more sequences of instructions for
2   converting an abstract quality of service policy into a new configuration for one or
3   more network devices, which instructions, when executed by one or more processors,
4   cause the one or more processors to carry out the steps of:
5   receiving the abstract quality of service policy;

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6   converting the abstract quality of service policy into a first set of one or more basic
7   commands;
8   receiving one or more first command line interface (CLI) commands that represent a
9   current configuration of a network device;
10   determining a second set of one or more basic commands that correspond to the
11   current configuration of the network device, based on the first CLI commands;
12   transforming the first and second sets of basic commands into one or more second
13   CLI commands which, when executed by the network device, will create a
14   new configuration for the network device that implements the abstract quality
15   of service policy.

1   12.   An apparatus for converting an abstract quality of service policy into a new
2   configuration for one or more network devices, comprising:
3   a quality of service management system that is coupled to a managed network
4   comprising the one or more network devices and including means for creating
5   and storing an abstract policy defining a quality of service for use by the
6   network devices in carrying one or more network traffic flows;
7   means for converting the abstract quality of service policy into a first set of one or
8   more basic commands;
9   means for receiving one or more first command line interface (CLI) commands that
10   represent a current configuration of a network device;
11   means for determining a second set of one or more basic commands that correspond
12   to the current configuration of the network device, based on the first CLI
13   commands; and
14   means for transforming the first and second sets of basic commands into one or more
15   second CLI commands which, when executed by the network device, will
16   create a new configuration for the network device that implements the abstract
17   quality of service policy.

1   13.   An apparatus for converting an abstract quality of service policy into a new
2   configuration for one or more network devices, comprising:

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3   a quality of service management system that is coupled to a managed network

4   comprising the one or more network devices and including means for creating

5   and storing an abstract policy defining a quality of service for use by the

6   network devices in carrying one or more network traffic flows;

7   basic command processing logic coupled to the quality of service management system

8   and comprising one or more sequences of instructions which, when executed by

9   one or more processors, causes the one or more processors to execute the steps

10   of:

11   converting the abstract quality of service policy into a first set of one or more

12   basic commands;

13   receiving one or more first command line interface (CLI) commands that

14   represent a current configuration of a network device;

15   determining a second set of one or more basic commands that correspond to the

16   current configuration of the network device, based on the first CLI

17   commands; and

18   transforming the first and second sets of basic commands into one or more

19   second CLI commands which, when executed by the network device,

20   will create a new configuration for the network device that implements

21   the abstract quality of service policy.

1   14.   A method as recited in Claim 1, wherein each basic command expresses control for a

2   network device at an intermediate level of abstraction that is lower than the abstract

3   policy and higher than the CLI commands.

1   15.   In a quality of service policy management system that controls deployment of quality

2   of service policies to a plurality of routers in a managed network, a method of

3   converting an abstract quality of service policy into a new configuration for one or

4   more of the routers, the method comprising the computer-implemented steps of:

5   receiving the abstract quality of service from the quality of service policy

6   management system;

7   converting the abstract quality of service policy into an initial set of one or more basic

8   commands;

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9   receiving one or more first router command line interface (CLI) commands that

10   represent a current configuration of one of the routers;

11   determining a set of one or more uploaded basic commands that correspond to the

12   current configuration of the router, based on the first CLI commands;

13   creating and storing a final set of basic commands based on the initial set of basic

14   commands and the uploaded basic commands;

15   transforming the final set of basic commands into one or more second CLI commands

16   which, when executed by the router, will create a new configuration for the

17   router that causes the router to implement the abstract quality of service

18   policy.

1   16.   A method as recited in Claim 15, wherein the step of transforming the final set of

2   basic commands comprises the steps of merging and aggregating the initial set and

3   uploaded basic commands by eliminating duplicate commands and combining similar

4   commands.

1   17.   A method as recited in Claim 15, wherein the steps of determining a set of one or

2   more uploaded basic commands comprise the steps of:

3   receiving the initial set of basic commands;

4   analyzing a current configuration of the network device;

5   determining an interim set of one or more CLI commands which, if executed by the

6   network device, would result in creating the current configuration;

7   converting the interim set of one or more CLI commands into a set of one or more

8   uploaded basic commands.

1   18.   A method as recited in Claim 16, wherein the steps of merging and aggregating the

2   initial first and second sets of basic commands comprises the steps of:

3   receiving the set of uploaded basic commands;

4   comparing the initial set of basic commands to the set of uploaded basic commands;

5   creating and storing a final list of basic commands by determining a minimal set of

6   basic commands which, if executed by the network device, would result in

7   creating a new device configuration that implements the abstract policy.

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1   19.   A method as recited in Claim 15, further comprising the steps of assigning a state
2   value of each basic command in the final list of basic commands upon creation of
3   each basic command.

1   20.   A method as recited in Claim 15, further comprising the step of assigning a state value
2   of DO to each basic command in the initial set upon creation of such basic command,
3   wherein such state value indicates that the associated basic command must be
4   deployed to the network device as part of deploying the new configuration.

1   21.   A method as recited in Claim 15, further comprising the step of selectively assigning
2   a state value UNDO or EXIST to each basic command in the set of uploaded basic
3   commands, wherein a state value of UNDO indicates that the associated basic
4   command should be removed from the network device as part of deploying the new
5   configuration, and wherein a state value of EXIST indicates that the associated basic
6   command is currently configured on the network device and may be removed or
7   retained as part of deploying the new configuration.

1   22.   A method as recited in Claim 21, wherein the steps of merging and aggregating the
2   initial and uploaded sets of basic commands comprises the steps of:
3   based on the state value of each basic command in the final list, translating each basic
4   command in the final list into one or more second CLI commands which, when
5   executed by the network device, will create a new configuration for the network
6   device that implements the abstract quality of service policy;
7   when two of the basic commands in the final list are equivalent without considering
8   their associated state values, and when one of the two commands has a state
9   value of DO and the second of the two commands has a state value of UNDO,
10   merging the two commands into one new command having a state value of
11   EXIST.

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